

State of California
The Resources Agency
Department of Water Resources
San Joaquin District



CROP WATER USE

**A Guide For Scheduling Irrigations in the Southern
San Joaquin Valley, 1977 - 1991**

March 1993

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Secretary for Resources
**The Resources
Agency**

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FOREWORD

This report is a substantially revised version of *Crop Water Use – A Guide for Scheduling Irrigations in the Southern San Joaquin Valley, 1977-1979*, published by the Department of Water Resources in September 1980.

That previous report has been updated to include data presented in eight annual published appendices (1980-1987) and four years of unpublished data (1988-1991).

This report summarizes estimates of crop water use calculated by DWR and provided to cooperating farm advisors in the three southern counties of the San Joaquin Valley during the 15-year period 1977 through 1991. Farm advisors disseminated this information within their counties to guide growers in scheduling irrigations for eight major crops representing about 85 percent of the irrigated land in the area. Rational irrigation scheduling – applying irrigation water at the right times and in the right amounts – contributes to both optimizing crop production and conserving the dwindling irrigation supplies in the area.

This report is divided into four major sections: (1) a brief historical perspective of the development of irrigation scheduling in California, (2) a description of the methods used in calculating crop water use estimates and transmitting those estimates to growers in the southern San Joaquin Valley, (3) an evaluation of the reliability of calculated crop water use estimates, and (4) weekly and monthly calculated crop water use estimates.

Based upon DWR's evaluation, the crop water use estimates were judged to be sufficiently reliable for scheduling crop irrigations.



Louis A. Beck, Chief
San Joaquin District

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STATE OF CALIFORNIA
Pete Wilson, Governor

THE RESOURCES AGENCY
Douglas P. Wheeler, Secretary for Resources

DEPARTMENT OF WATER RESOURCES
David N. Kennedy, Director

John J. Silveira
Deputy Director

Robert G. Potter
Chief Deputy Director

Carroll M. Hamon
Deputy Director

L. Lucinda Chipponeri
Assistant Director for Legislation

Susan N. Weber
Chief Counsel

Division of Local Assistance

Carlos Madrid Chief

San Joaquin District

Louis A. Beck District Chief
Victor B. McIntyre Chief, Resources Branch

This report was prepared by

Norman A. MacGillivray Senior Land and Water Use Analyst

with assistance from

Daniel J. Wightman Research Writer
Kenneth W. Winden Senior Delineator
Carolyn A. Brown Executive Secretary
Joan S. Leonard Office Technician

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HISTORY

Agricultural scientists have long recognized the benefits derived from matching irrigation applications to crop water needs. Research results defining the interrelationships between various irrigation treatments, fertility levels, and crop yields are available for most California crops.

The University of California, Cooperative Extension, and the U.S. Soil Conservation Service - two agencies that directly serve California growers - have, for many years, advocated careful scheduling of irrigations to achieve optimum yields. Generally, they recommend monitoring soil moisture levels within the crop root zone throughout the growing season. Soil moisture may be estimated by examining samples augered from the crop root zone or by using moisture-sensing devices such as tensiometers or electrical resistance blocks. These methods are technically sound and have been demonstrated to be reliable for on-farm irrigation management.

In the late 1940s to early 1950s, soil moisture budgeting was advanced as an easy method to track soil moisture contents indirectly. Starting with the total available soil moisture, crop evapotranspiration amounts are subtracted and irrigation and rainfall amounts are added to estimate current moisture levels. In past years, when water was relatively abundant and inexpensive, such procedures were not widely used by growers. Now, however, with available irrigation supplies decreasing and operating costs rapidly increasing, growers are becoming more and more interested in upgrading their irrigation management practices.

In the late 1960s, the U.S. Bureau of Reclamation began offering an Irrigation Management Service designed to improve irrigation efficiencies within federal water service areas throughout the western states.

In the San Joaquin Valley, USBR provided this management service to three water districts, all located in western Fresno County. Irrigation Management Service had three levels of intensity:

1. Monitoring actual soil moisture levels in specific fields.
2. Calculating current crop (ET) rates for specific crops within a water service district.
3. Calculating daily potential ET-alfalfa (ETP) rates for large geographic areas.¹

¹ETP is the ET rate of vigorously growing alfalfa at 100-percent ground cover and with no moisture stress. ETP is usually calculated from meteorological data. ET rates for specific crops, at specific stages of development, may be estimated from ETP and the predetermined relationship between crop ET and ETP.

The first level provided data for the direct scheduling of irrigations on specific fields. The second level provided estimates of current crop ET rates which, when coupled with determinations of available soil moisture storage capacity for specific fields, could be used to maintain a soil moisture budget and thus determine when moisture needed to be replenished by irrigations. The third level, ETP, gave a general appraisal of variations in ET demands and, when used with proper coefficients, provided a basis for estimating crop ET. Irrigation Management Service has been continued by some irrigation/water districts in California – at least one in the San Joaquin Valley – as an in-house activity. One important product of the service was the growers' increased awareness of benefits gained from proper irrigation management. This awareness has resulted in ever-increasing opportunities for private agricultural consultants who are assisting growers by maintaining soil moisture budgets and/or monitoring soil moisture to forecast irrigation dates and amounts of water to be applied to specific crops and fields.

In 1982, the University of California, Davis, with funding from DWR's Office of Water Conservation, developed a method for estimating reference crop ET from remote climate sensors throughout the State. This is the California Irrigation Management Information Service. DWR has for several years been engaged in a major effort to implement that method.

Several large farming operations have developed in-house capability for rational irrigation scheduling.

In 1977 – the year of California's great drought – to help stretch the limited irrigation supplies then available, water scientists from UCCE and DWR initiated a cooperative effort to provide current crop water use data to those major agricultural areas not then served by the USBR's Irrigation Management Service. The southern San Joaquin Valley is one such area (see Figure 1). This effort, continued through 1991 in the southern Valley, is described in this report.

Procedures for calculating and disseminating crop water use data are described on the following pages. Summaries of estimated crop water use (ET) are included in Appendices A through D.

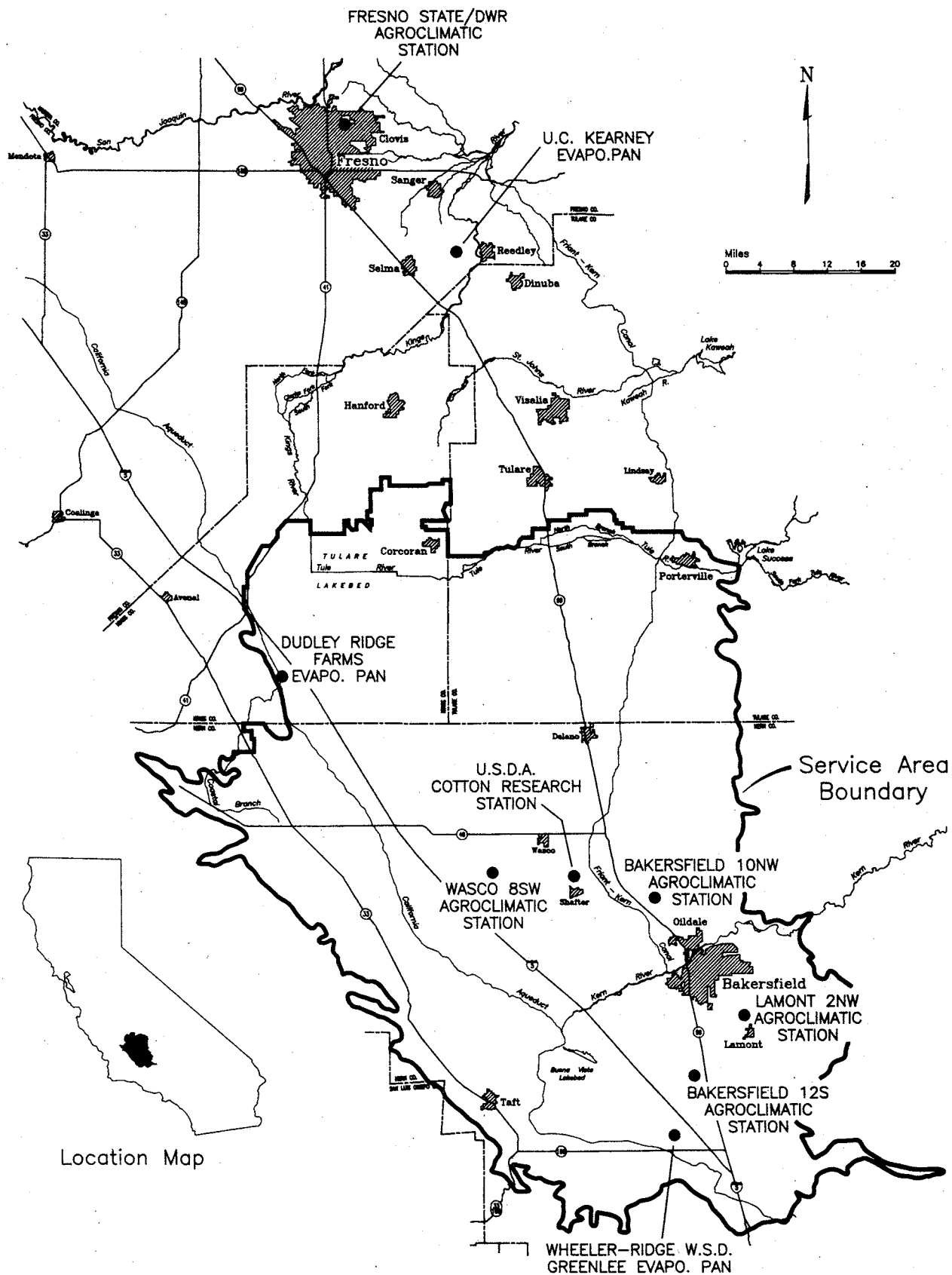


Figure 1. Service Area – Crop Water Use in the Southern San Joaquin Valley